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WHAT IS CLAIMED IS:

1. A method of forming a dielectric layer, comprising the steps of:
annealing a polysilicon substrate in nitric oxide to form an oxide layer;
nitridizing the oxide layer to form an nitride layer; and
depositing the dielectric layer onto the nitride layer.

2. A method of forming a dielectric layer, comprising the steps of:
annealing a polysilicon substrate in nitric oxide at a temperature of less than 800°C. to form an oxynitride layer;
nitridizing the oxynitride layer to form a nitride layer; and
depositing the dielectric layer onto the nitride layer.

3. The method of Claim 2, wherein the step of annealing the polysilicon substrate is at a temperature of about 700 to about 750°C.

4. The method of Claim 1, wherein the polysilicon layer comprises a polysilicon selected from the group consisting of doped polysilicon, undoped polysilicon, and HSG polysilicon.

5. The method of Claim 1, wherein the oxynitride layer is about 40 angstroms or less.

6. The method of Claim 1, wherein the oxynitride is less than 15 angstroms thick.

7. A method of forming a dielectric layer, comprising the steps of:
annealing a polysilicon substrate in nitric oxide at a temperature of less than 800°C. to form an oxynitride layer;
nitridizing the oxynitride layer to form a nitride layer by exposing the oxynitride layer to a nitrogen-containing gas; and
depositing the dielectric layer onto the nitride layer.

8. The method of Claim 7, wherein the nitrogen-containing gas is selected from the group consisting of nitrogen, ammonia, nitrous oxide, and nitric oxide.

9. The method of Claim 7, wherein the nitrogen-containing gas is selected from the group consisting of a plasma mixture of nitrogen and helium, and a plasma mixture of nitrogen and argon.

10. The method of Claim 7, wherein the step of nitridizing comprises exposing the oxynitride layer to an active nitrogen-containing species formed in a plasma.

11. The method of Claim 7, wherein the step of nitridizing the oxynitride layer is at a temperature of about 0 to about 900°C.

12. The method of Claim 7, wherein the oxynitride layer and nitride layer have a combined thickness of about 10 to about 40 angstroms.

13. A method of forming a dielectric layer, comprising the steps of:
annealing a polysilicon substrate in nitric oxide to form an oxynitride layer;
nitridizing the oxynitride layer to form a nitride layer; and
depositing a high K dielectric layer onto the nitride layer.

14. The method of Claim 13, wherein the dielectric material is selected from the group consisting of tantalum pentoxide, titanium dioxide, barium strontium titanate, strontium titanate, barium titanate, lead zirconium titanate, strontium bismuth tantalate, hafnium oxide, zirconium oxide, and aluminum oxide.

15. The method of Claim 13, wherein the dielectric layer comprises tantalum pentoxide.

16. The method of Claim 13, further comprising, after the step of forming the dielectric layer, annealing the dielectric layer in an oxidizing gas.

17. The method of Claim 16, wherein the oxidizing gas is selected from the group consisting of oxygen, plasma oxygen, ozone, nitrous oxide, and mixtures thereof.

18. A method of forming a dielectric layer, comprising the steps of:

annealing a polysilicon substrate in nitric oxide at a temperature less than 800°C. to form an oxynitride layer;

nitridizing the oxynitride layer in a nitrogen-containing gas to form an nitride layer;

depositing a high K dielectric layer onto the nitride layer; and

annealing the dielectric layer in an oxidizing ambient.

19. The method of Claim 18, wherein the step of annealing the polysilicon substrate is at a temperature of about 700 to about 750°C.

20. The method of Claim 18, wherein the oxynitride layer has a thickness that is substantially the same before and after the step of annealing the dielectric layer.

21. The method of Claim 18, wherein the oxynitride is about 40 angstroms or less.

22. The method of Claim 18, wherein the oxynitride layer is less than 15 angstroms.

23. A method of forming a dielectric layer on a semiconductor substrate, comprising the steps of:

annealing a polysilicon substrate in nitric oxide at a temperature of less than 800°C to form an oxide layer having a thickness of about 40 angstrom or less;

exposing the oxide layer to a nitrogen-containing gas to form a nitrided oxide layer; and

forming a high K dielectric layer over the nitrided oxide layer.

24. A method of forming a dielectric layer on a semiconductor substrate, comprising the steps of:

annealing a polysilicon substrate in nitric oxide at a temperature of about less than 800°C to form an oxide layer having a thickness of about 40 angstroms or less;

exposing the oxide layer to a nitrogen-containing gas to form a nitrided oxide layer;

forming a high K dielectric layer over the nitrided oxide layer; and

annealing the dielectric layer in an oxidizing ambient;

whereby the thickness of the nitrided oxide layer after the step of annealing the dielectric layer is about 40 angstroms or less.

25. A method of forming a dielectric layer, comprising the steps of:

providing a polysilicon substrate;

heating treating the polysilicon substrate in nitric oxide to form a thin oxide layer over the polysilicon substrate;

exposing the oxide layer to a nitrogen-containing gas to form a nitride layer; and

forming a high K dielectric layer over the nitride layer.

26. A method of forming a dielectric layer, comprising the steps of:

providing a substrate comprising polysilicon;

forming an oxide layer over the polysilicon substrate by heat treating the polysilicon substrate in nitric oxide at a temperature of less than 800°C, such that nitrogen concentrates within the oxide layer at an interface between the oxide layer and the polysilicon substrate.

forming a nitride layer over the oxide layer by exposing the oxide layer to a nitrogen-containing gas; and

forming a high K dielectric layer over the nitride layer.

27. A method of forming a dielectric layer, comprising the steps of:

annealing a polysilicon substrate in nitric oxide at a temperature of less than 800°C. to form an oxynitride layer;

nitridizing the oxynitride layer to form a nitride layer by exposing the oxynitride layer to an activated nitrogen-containing gas to form a nitrided oxide layer; and

depositing the dielectric layer onto the nitrided oxide layer.

28. The method of Claim 27, wherein the nitrogen-containing gas is selected from the group consisting of nitrogen, ammonia, nitrous oxide, and nitric oxide.

29. The method of Claim 27, wherein the step of nitridizing comprises exposing the oxynitride layer to an active nitrogen-containing species formed in a plasma.

30. The method of Claim 27, wherein the step of nitridizing the oxynitride layer is at a temperature of about 0 to about 900°C.

31. The method of Claim 27, wherein the oxynitride layer and nitride layer have a combined thickness of about 10 to about 40 angstroms.

32. A method of forming a dielectric layer, comprising the steps of:

annealing a polysilicon substrate in nitric oxide to form an oxynitride layer;

nitridizing the oxynitride layer in an activated nitrogen-containing gas to form a nitrided oxide layer; and

depositing a high K dielectric layer onto the nitride layer.

33. A method of forming a dielectric layer on a semiconductor substrate, comprising the steps of:

providing a substrate comprising HSG polysilicon;

annealing the polysilicon substrate in nitric oxide at a temperature of about 700°C. to about 750°C. to form an oxide layer having a thickness of about 40 angstroms or less;

exposing the oxide layer to a nitrogen-containing gas to form a nitrided oxide layer;

forming a layer comprising tantalum pentoxide over the nitrided oxide layer; and

annealing the tantalum pentoxide layer in an oxidizing ambient;

whereby the thickness of the nitrided oxide layer is about 40 angstroms or less.

34. A method of forming a dielectric layer on a semiconductor substrate, comprising the steps of:

providing a substrate comprising HSG polysilicon;

annealing the polysilicon substrate in nitric oxide at a temperature of about 700°C. to about 750°C. to form an oxide layer having a thickness of about 40 angstroms or less;

exposing the oxide layer to an activated nitrogen-containing gas to form a nitrided oxide layer;

forming a layer comprising tantalum pentoxide over the nitrided oxide layer; and

annealing the tantalum pentoxide layer in an oxidizing ambient;

whereby the thickness of the nitrided oxide layer is about 40 angstroms or less.

35. A method of forming a semiconductor device above a semiconducting substrate having a surface, comprising the steps of:

forming a nitrided oxynitride layer over a polysilicon substrate by annealing the polysilicon substrate in the presence of a nitric oxide at a temperature of about 700 to about 750°C. to form an oxynitride layer, and nitridizing the oxynitride layer in a nitrogen-containing gas; the nitrided oxynitride layer having a thickness of about 40 angstroms or less; and

forming a dielectric layer over the nitrided oxynitride layer.

36. The method of Claim 35, wherein the dielectric material comprises a high K dielectric.

37. The method of Claim 36, wherein the dielectric material is selected from the group consisting of tantalum pentoxide, titanium dioxide, barium strontium titanate, strontium titanate, barium titanate, lead zirconium titanate, strontium bismuth tantalate, hafnium oxide, zirconium oxide, and aluminum oxide.

38. The method of Claim 36, wherein the dielectric layer comprises tantalum pentoxide.

39. The method of Claim 36, further comprising, after the step of forming the dielectric layer, annealing the dielectric layer in an oxidizing gas, wherein the thickness of the nitrided oxynitride layer is about 40 angstroms or less.

40. The method of Claim 39, wherein the oxidizing gas is selected from the group consisting of oxygen, plasma oxygen, ozone, nitrous oxide, and mixtures thereof.

41. A method of forming a semiconductor device above a semiconducting substrate having a surface, comprising the steps of:

forming a nitrided oxynitride layer over a polysilicon substrate by annealing the polysilicon substrate in the presence of a nitric oxide at a temperature of about 700 to about 750°C. to form an oxynitride layer, and nitridizing the oxynitride layer in an activated nitrogen-containing gas; the nitrided oxynitride layer having a thickness of about 40 angstroms or less; and

forming a dielectric layer over the nitrided oxynitride layer.

42. The method of Claim 41, wherein the dielectric material comprises a high K dielectric.

43. A method of forming a dielectric layer in a capacitor container comprising an opening formed in an insulative layer and a lower electrode comprising polysilicon formed within the opening, the method comprising the steps of:

forming an oxynitride layer over the lower electrode by annealing the electrode in the presence of nitric oxide;

nitridizing the oxynitride layer in a nitrogen-containing gas; and

forming a high K dielectric layer over the nitridized oxynitride layer.

44. The method of Claim 43, wherein the step of annealing the lower electrode is at a temperature of about 700 to about 750°C.

45. The method of Claim 43, further comprising annealing the dielectric layer in an oxidizing ambient.

46. A method of forming a dielectric layer in a capacitor container comprising an opening formed in an insulative layer and a lower electrode comprising polysilicon formed within the opening, the method comprising the steps of:

forming an oxynitride layer over the lower electrode by annealing the electrode in the presence of nitric oxide;

nitridizing the oxynitride layer in an activated nitrogen-containing gas; and

forming a high K dielectric layer over the nitridized oxynitride layer.

47. The method of Claim 46, wherein the step of annealing the lower electrode is at a temperature of about 700 to about 750°C.

48. A method of forming a capacitor, comprising the steps of:

forming a first capacitor electrode comprising polysilicon over a substrate;

forming an oxynitride layer over the first capacitor electrode by annealing the electrode in the presence of nitric oxide;

nitridizing the oxynitride layer in a nitrogen-containing gas; and

forming a dielectric layer over the oxynitride layer.

49. The method of Claim 48, wherein the dielectric material comprises a high K dielectric.

50. The method of Claim 49, wherein the dielectric material is selected from the group consisting of tantalum pentoxide, titanium dioxide, barium strontium titanate, strontium

titanate, barium titanate, lead zirconium titanate, strontium bismuth tantalate, hafnium oxide, zirconium oxide, and aluminum oxide.

51. The method of Claim 49, wherein the dielectric layer comprises tantalum pentoxide.

52. The method of Claim 49, further comprising, after the step of forming the dielectric layer, annealing the dielectric layer in an oxidizing gas.

53. A method of forming a capacitor, comprising the steps of:

forming a first capacitor electrode comprising polysilicon over a substrate;

forming an oxynitride layer over the first capacitor electrode by annealing the electrode in the presence of nitric oxide;

nitridizing the oxynitride layer in an activated nitrogen-containing gas; and

forming a dielectric layer over the oxynitride layer.

54. A method of forming a capacitor, comprising the steps of:

providing a substrate comprising an overlying insulative layer and a container opening formed in the insulating layer to an active area on the substrate, and a lower electrode comprising polysilicon formed within the container opening;

forming an oxynitride layer over the lower electrode by annealing the electrode in the presence of nitric oxide;

nitridizing the oxynitride layer in a nitrogen-containing gas;

forming a high K dielectric layer over the oxynitride layer; and

annealing the dielectric layer in an oxidizing gas.

55. The method of Claim 54, wherein the step of forming the oxynitride layer comprises:

annealing the polysilicon electrode in the presence of nitric oxide at a temperature of less than 800°C. to form an oxynitride layer having a thickness about 40 angstroms or less.

56. A method of forming a capacitor, comprising the steps of:

providing a substrate comprising an overlying insulative layer and a container opening formed in the insulating layer to an active area on the substrate, and a lower electrode comprising polysilicon formed within the container openings;

forming an oxynitride layer over the lower electrode by annealing the electrode in the presence of nitric oxide;

nitridizing the oxynitride layer in an activated nitrogen-containing gas;

forming a high K dielectric layer over the oxynitride layer; and

annealing the dielectric layer in an oxidizing gas.

57. A method of forming a capacitor in a semiconductor device, comprising the steps of:

providing a substrate with an opening;

forming a first conductive electrode layer within the opening; the first electrode layer comprising hemispherical grain polysilicon;

forming a thin layer of oxynitride over the first electrode layer by annealing the electrode in the presence of nitric oxide;

nitridizing the oxynitride layer in a nitrogen-containing gas;

forming an insulative layer over the oxynitride layer; the insulative layer comprising an insulating inorganic metal oxide material; and

forming a second conductive electrode layer over the insulative layer.

58. The method of Claim 57, wherein the insulating inorganic metal oxide material comprises a high K dielectric.

59. The method of Claim 58, wherein the insulating inorganic metal oxide material is selected from the group consisting of tantalum pentoxide, titanium dioxide, barium strontium titanate, strontium titanate, barium titanate, lead zirconium titanate, strontium bismuth tantalate, hafnium oxide, zirconium oxide, and aluminum oxide.

60. The method of Claim 58, wherein the insulating inorganic metal oxide material comprises tantalum pentoxide.

61. The method of Claim 57, further comprising, after the step of forming the insulating inorganic metal oxide material layer, annealing the layer in an oxidizing gas.

62. The method of Claim 57, wherein the step of forming the oxynitride layer comprises:

annealing the polysilicon electrode in the presence of nitric oxide at a temperature of about 700 to about 750°C. to form an oxynitride layer having a thickness of about 40 angstroms or less.

63. A semiconductor device formed above a substrate, comprising:

a polysilicon layer;

an oxynitride layer overlying the polysilicon layer; the oxynitride layer comprising a nitric oxide grown oxide layer having a nitridized surface and a thickness of about 40 angstroms or less; and

a high K dielectric layer overlying the oxynitride layer.

64. The device of Claim 63, wherein the dielectric layer comprises a high K material selected from the group consisting of tantalum pentoxide, titanium dioxide, barium strontium titanate, strontium titanate, barium titanate, lead zirconium titanate, strontium bismuth tantalate, hafnium oxide, zirconium oxide, and aluminum oxide.

65. The device of Claim 63, wherein the high K dielectric layer comprises tantalum pentoxide.

66. The device of Claim 63, wherein the dielectric layer is oxygen annealed.

67. A semiconductor device formed above a substrate, comprising:

a polysilicon layer;

an oxynitride layer overlying the polysilicon layer; the oxynitride layer comprising a nitric oxide grown oxide layer having a surface nitridized in an activated nitrogen-containing gas, and a thickness of about 40 angstroms or less; and a high K dielectric layer overlying the oxynitride layer.

68. A semiconductor device formed above a substrate, comprising:

a polysilicon layer;

an oxynitride layer overlying the polysilicon layer; the oxynitride layer comprising a nitric oxide grown oxide layer having a nitridized surface and a thickness of about 40 angstroms or less; and

a dielectric layer comprising Ta_2O_5 overlying the oxynitride layer.

69. A capacitor, comprising:

a first conductive capacitor plate comprising polysilicon;

a thin oxynitride layer overlying the first capacitor plate, the oxynitride layer comprising an oxide layer grown in the presence of nitric oxide and a surface nitridized in a nitrogen-containing gas; and

a dielectric layer overlying the oxynitride layer.

70. A capacitor, comprising:

a first conductive capacitor plate comprising polysilicon;

a thin oxynitride layer overlying the first capacitor plate, the oxynitride layer comprising an oxide layer grown in the presence of nitric oxide and nitridized in a nitrogen-containing gas; the oxynitride layer having a thickness of about 40 angstroms or less;

a high K dielectric layer overlying the oxynitride layer; and

a second conductive capacitor plate overlying the dielectric layer.

71. A capacitor, comprising:

a container formed in an insulative material, and a lower capacitor electrode comprising polysilicon formed in the container;

an oxynitride layer overlying the lower capacitor electrode; the oxynitride layer comprising a nitric oxide grown oxide layer having a nitridized surface and a thickness of about 40 angstroms or less; and

a dielectric layer overlying the oxynitride layer.

72. A capacitor, comprising:

a container formed in an insulative material, and a lower capacitor electrode comprising polysilicon formed in the container;

an oxynitride layer overlying the lower capacitor electrode; the oxynitride layer comprising a nitric oxide grown oxide layer having a surface nitridized in an activated nitrogen-containing gas and a thickness of about 40 angstroms or less;

a dielectric layer overlying the oxynitride layer.

73. A capacitor, comprising:

a container formed in an insulative material, and a lower capacitor electrode comprising polysilicon formed in the container;

an oxynitride layer overlying the lower capacitor electrode; the oxynitride layer comprising a nitric oxide grown oxide layer having a nitridized surface and a thickness of about 40 angstroms or less;

a high K dielectric layer overlying the oxynitride layer; and

an upper capacitor electrode overlying the dielectric layer.

74. The capacitor of Claim 73, wherein the dielectric layer comprises a high K material selected from the group consisting of tantalum pentoxide, titanium dioxide, barium strontium titanate, strontium titanate, barium titanate, lead zirconium titanate, strontium bismuth tantalate, hafnium oxide, zirconium oxide, and aluminum oxide.

75. The capacitor of Claim 73, wherein the dielectric layer comprises tantalum pentoxide.

76. A capacitor, comprising:

a container formed in an insulative material, and a lower capacitor electrode comprising polysilicon formed in the container;

an oxynitride layer overlying the lower capacitor electrode; the oxynitride layer comprising a nitric oxide grown oxide layer having a surface nitridized in an activated nitrogen-containing gas; and a thickness of about 40 angstroms or less;

a high K dielectric layer overlying the oxynitride layer; and

an upper capacitor electrode overlying the dielectric layer.

77. A capacitor, comprising:

a container formed in an insulative material, and a lower capacitor electrode comprising polysilicon formed in the container;

an oxynitride layer overlying the lower capacitor electrode; the oxynitride layer comprising a nitric oxide grown oxide layer having a nitridized surface and a thickness of about 40 angstroms or less;

a dielectric layer comprising Ta_2O_5 overlying the oxynitride layer; and

an upper capacitor electrode overlying the dielectric layer.